APPLICATION NO. 10/709780

September 13, 2005

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CLMPTO
CLAIMS 1-59
(CANCELLED)

60. (Currently Amended) A light emitting diode ~~("LED")~~ comprising: a silicon carbide wafer having a first and second surface and having a predetermined conductivity type and an initial carrier concentration; a region of implanted dopant atoms extending from said first surface into said silicon carbide wafer for a predetermined distance, said region having a

higher carrier concentration than said initial carrier concentration in the remainder of said wafer; a conductive buffer region on said first surface of said conductive silicon carbide wafer; an active region on said conductive buffer region; a first ohmic contact to said active region; and a second ohmic contact on the second surface of said silicon carbide wafer.

61. (Original) An LED according to claim 60 wherein said active layer is a single heterostructure.

62. (Original) An LED according to claim 60 wherein said active layer is a double heterostructure.

63. (Original) An LED according to claim 60 wherein said active layer is a single quantum well.

64. (Original) An LED according to claim 60 wherein said active layer is a multiple quantum well.

65. (Original) An LED according to claim 60 wherein said silicon carbide wafer comprises n-type 6H-silicon carbide.

66. (Original) An LED according to claim 65 wherein said initial carrier concentration of said silicon carbide wafer comprises nitrogen.

67. (Original) An LED according to claim 66 wherein said carrier concentration of said nitrogen is about 5E17 to 3E18 cm^{-3}.

68. (Original) An LED according to claim 65 wherein said initial carrier concentration of said silicon carbide wafer comprises phosphorus.

69. (Original) An LED according to claim 60 wherein said region of implanted dopant atoms comprises phosphorus atoms with an implant concentration of between about 1E19 and 5E21 cm^{-3}.

70. (Original) An LED according to claim 69 wherein said region of implanted dopant atoms comprises phosphorus dopant atoms with an implant concentration of about 1E21 cm^{-3}.

71. (Original) An LED according to claim 60 wherein said region of implanted dopant atoms comprises nitrogen dopant atoms with an implant concentration of between about 1E19 and 5E21 cm^{-3}.

72. (Original) An LED according to claim 71 wherein said region of implanted dopant atoms comprises phosphorus atoms with an implant concentration of about 1E21 cm^{-3}.

73. (Original) An LED according to claim 60 wherein said silicon carbide wafer comprises n-type 4H-silicon carbide.

74. (Original) An LED according to claim 60 wherein said region of implanted dopant atoms extends from said first surface into said silicon carbide wafer to a depth of between about 10 and 5000 Angstroms.

75. (Original) An LED according to claim 60 wherein said region of implanted dopant atoms extends from said first surface into said silicon carbide wafer to a depth of between about 800 and 1000 Angstroms.

76. (Original) An LED according to claim 60 wherein said region of implanted dopant atoms has a peak concentration of implanted dopant atoms of between about 1E19 and 5E21 cm^{-3}.

77. (Original) An LED according to claim 76 wherein said region of implanted dopant atoms has a peak concentration of implanted dopant atoms of about 1E21 cm^{-3} and extends from said first surface into said silicon carbide wafer to a depth of about 500 Angstroms.

78. (Original) An LED according to claim 60 wherein the peak concentration of implanted atoms in said implanted region occurs at or near the first surface of said silicon carbide substrate.

79. (Original) A light emitting diode ("LED") comprising: a silicon carbide wafer having a first and second surface and having a predetermined conductivity type and an initial carrier concentration; a conductive buffer region on the first surface of said silicon carbide substrate; a region of implanted dopant atoms having the same conductivity as said wafer and extending from said first surface into said silicon carbide wafer for a predetermined distance causing a reduction of the overall forward voltage drop observable at the interface between said wafer and said conductive buffer region; an active region on said conductive buffer region; an ohmic contact to said active region; and an ohmic contact on said second surface of said silicon carbide substrate.

80. (Original) An LED according to claim 79 wherein said implanted region has a peak concentration of implanted dopant atoms of between about 1E19 and 5E21 cm^{-3}.

81. (Original) An LED according to claim 79 wherein said implanted region has a thickness of between about 10 and 5000 Angstroms.

82. (Original) An LED according to claim 79 wherein said implanted region has a peak concentration of implanted dopant atoms of about 1E21 cm^{-3} and is about 500 Angstroms thick.

83. (Original) An LED according to claim 79 wherein said implanted region is doped with atoms selected from the group consisting of nitrogen and phosphorus.

84. (Original) An LED according to claim 79 wherein said implanted region comprises phosphorus donor atoms implanted with first dose at a net dopant concentration of 2E15 cm^{-2} at an energy of 25 keV and a second dose at a net dopant concentration of 3.6E15 cm^{-2} at an energy of 50 keV.

85. (Original) An LED according to claim 79 wherein said region of implanted dopant atoms extends into said substrate to a depth of between about 800 and 1000 Angstroms.

86. (Original) An LED according to claim 79 wherein said active region is a single heterostructure.

87. (Original) An LED according to claim 79 wherein said active region is a double heterostructure.

88. (Original) An LED according to claim 79 wherein said active region is a single quantum well.

89. (Original) An LED according to claim 79 wherein said active region is a multiple quantum well.

90. (Original) An LED according to claim 79 wherein said silicon carbide wafer comprises n-type 6H-silicon carbide having an initial ion concentration of nitrogen donor atoms of between about 5E17 and 3E18 cm^{-3} and wherein said region of implanted dopant atoms comprises phosphorus dopant atoms with an implant concentration of between about 1E19 and 5E21 cm^{-3} and is about 500 Angstroms thick.

91. (Original) An LED according to claim 79 wherein said silicon carbide wafer comprises n-type 6H-silicon carbide having an initial ion concentration of nitrogen donor atoms of between about 5E17 and 3E18 cm^{-3} and wherein said region of implanted dopant atoms comprises nitrogen dopant atoms with an implant concentration of between about 1E19 and 5E21 cm^{-3} and is about 500 Angstroms thick.

92. (Original) An LED according to claim 79 wherein said silicon carbide wafer comprises n-type 4H-silicon carbide having an initial ion concentration of nitrogen donor atoms of between about 5E17 and 3E18 cm^{-3} and wherein said region of implanted dopant atoms comprises phosphorus dopant atoms with an implant concentration of between about 1E19 and 5E21 cm^{-3} and is about 500 Angstroms thick.

93. (Original) An LED according to claim 79 wherein said silicon carbide wafer comprises n-type 4H-silicon carbide having an initial ion concentration of nitrogen donor atoms of between about 5E17 and 3E18 cm^{-3} and wherein said region of implanted dopant atoms comprises nitrogen dopant atoms with an implant concentration of between about 1E19 and 5E21 cm^{-3} and is about 500 Angstroms thick.